



# Missouri Department of Natural Resources

Water Protection And Soil Conservation Division  
Public Drinking Water Program

## MODEL

Emergency Operating Plan  
For Public Water Supplies

### **Water Treatment Emergencies**

Before The Emergency (Vulnerability Assessment)

- General
- Security
- Power
- Chemical Feed
- Treatment Basins
- Filters
- Clearwells
- Finished Water Pump Station
- Buildings
- Administrative Offices and Laboratories

During The Emergency

After The Emergency

PUBLIC WATER SYSTEM  
MODEL EMERGENCY OPERATING PLAN

**WATER TREATMENT EMERGENCIES**

The most common problems with treatment plants in emergency situations are:

- X     loss of power
- X     loss of controls
- X     structural damage to basins, buildings, yard piping, etc.
- X     contamination of treatment processes
- X     loss of chemical feed equipment
- X     shortages of chemicals
- X     spills and overfeeds of treatment chemicals

**BEFORE THE EMERGENCY (VULNERABILITY ASSESSMENT)**

Before an emergency, think about how your plant may not work in an emergency. The questions below should help you find weak areas. Think about what you can do to improve these areas. Some areas can be helped by asking others to borrow equipment. Other areas will need physical improvement. Plan to do these system improvements over the next few years. You need to have a plan for what to do until the improvements are built.

**General**

Is your water treatment plant susceptible to natural and human-caused hazards such as drought, earthquake, flood, tornado, winter storms, security threats, contamination, or nuclear release?

Where are drawings and information about the plant kept? List building location and the location in the building or use the *Maps* section to list locations. \_\_\_\_\_

Where is a sketch of how to get to the plant? The *Maps* section is a convenient place to keep these kinds of sketches. \_\_\_\_\_

Where are operating instructions for plant equipment kept? List building location and the location in the building. \_\_\_\_\_

Where is a topographic map of the plant that gives elevations of building, basins, manholes, etc.?

Are drawings, information, and operating instructions stored above flood levels and in a fire-protected area? \_\_\_\_\_

How will you get to the plant in a flood or other emergency? \_\_\_\_\_

How will supply trucks, such as chemical feed, get to the plant in a flood or other emergency?

Do you have alternative routes? \_\_\_\_\_

Where are boats and 4-wheel drive vehicles kept? \_\_\_\_\_

Have trees/branches directly adjacent to overhead lines/buildings/basins been removed to prevent damage caused by falling limbs/trees laden with snow and ice? \_\_\_\_\_

Are vulnerable chemicals and equipment, such as transformers, electrical controls, motors, batteries and standby generators anchored to prevent movement or toppling? \_\_\_\_\_

Are piping on walls or ceilings supported to prevent damage from 'swinging' movements? \_\_\_\_\_

Are flexible piping provided to prevent settlement especially at a building's edge? \_\_\_\_\_

### **Security**

Are restricted areas posted with "Employees Only" or Restricted Area" signs?

Is access to plant facilities restricted by fence, locked gates, alarms or other physical barriers?

Are only authorized personnel given access keys or codes for locked facilities? \_\_\_\_\_

Who has keys to locked facilities? \_\_\_\_\_

Are locks tamper-proof? \_\_\_\_\_

Where are duplicate keys or codes located? \_\_\_\_\_

Is adequate exterior or interior lighting in place? \_\_\_\_\_

Are plant buildings and grounds monitored? \_\_\_\_\_

By utility staff / intrusion alarms / television monitors? \_\_\_\_\_

Does staff vary security checks plant and grounds to avoid predictable patterns? \_\_\_\_\_

If alarm is activated, what is the response plan? \_\_\_\_\_

Do local law enforcement personnel perform regular security checks? \_\_\_\_\_

Are local homeowners/landowners aware of need for security with telephone number(s) to call to report suspicious behavior? \_\_\_\_\_

Are procedures in-place when specific security threats are issued by local/national law enforcement authorities? \_\_\_\_\_

Is a contamination monitoring system in place, operational and tested?

What will you do if there is a security threat/violation? \_\_\_\_\_

Are general operational procedures varied in frequency by personnel? \_\_\_\_\_

Is mail opened off-site? \_\_\_\_\_

Are visitors required to show identification and sign a log-in? \_\_\_\_\_

Is access to critical areas limited to visitors? \_\_\_\_\_

Are background checks conducted for all contractors? \_\_\_\_\_

Is identification checked and verified for all chemical suppliers at delivery?

Are all delivered chemicals tested to verify authenticity? \_\_\_\_\_

## Power

What are the power sources? \_\_\_\_\_

Have you coordinated with electric utility for priority feed to plant? \_\_\_\_\_

Do you have an emergency generator that can be used for the plant? \_\_\_\_\_

Where is this generator stored? \_\_\_\_\_

Are generators exercised regularly? \_\_\_\_\_

Who knows how to operate the generator? \_\_\_\_\_

Where are the directions (operating manual) for the generator? \_\_\_\_\_

Where is the fuel kept? \_\_\_\_\_

Where do you buy fuel? \_\_\_\_\_

Where can you get a generator if you do not have one? \_\_\_\_\_

Where are the electric lines? \_\_\_\_\_

Where is the meter? \_\_\_\_\_

Where is the main power switch? \_\_\_\_\_

What meters, lines, etc. are below the 100 or 500-year flood level? \_\_\_\_\_

Is the substation feeding the plant in the 100 or 500-year floodplain? \_\_\_\_\_

Have you talked to the power company about how they will supply power during an emergency? \_\_\_\_\_

How will they supply power? \_\_\_\_\_

## Chemical Feed

Answer these questions for each water treatment chemical you use.

Chemical Name \_\_\_\_\_

How much chemical do you store? \_\_\_\_\_

How many days supply is this in normal operations? \_\_\_\_\_

How many days supply is this if the water is hard to treat? \_\_\_\_\_

Where are the operating manuals for the chemical feed equipment? \_\_\_\_\_

Who knows how to run the chemical feed equipment? \_\_\_\_\_

Are the chemical feed pumps below the 100 or 500-year flood level? \_\_\_\_\_

How will you protect this equipment? \_\_\_\_\_

Where is the storage for the chemical? \_\_\_\_\_

Where is the day storage for the chemical? \_\_\_\_\_

Are any of these storage areas below the 100 or 500-year level? \_\_\_\_\_

How will you protect stored chemicals from hazards? \_\_\_\_\_

Are the controls of the chemical feed automatic or manual? \_\_\_\_\_

What happens if the automatic control is lost? \_\_\_\_\_

What happens if the chemical is overfed? (see Appendix J for chlorine and Appendix K for other chemicals) \_\_\_\_\_

What happens if the chemical is spilled? (see Appendix J for chlorine and Appendix K for other chemicals) \_\_\_\_\_

What happens if you run out of this chemical? \_\_\_\_\_

Where is the safety equipment for this chemical stored, i.e., gloves, respirators? \_\_\_\_\_

Who knows proper safety procedures for this chemical? \_\_\_\_\_

Who will order chemicals before plant becomes inaccessible? \_\_\_\_\_

### **Treatment Basins**

What are the elevations of the treatment basins?

Top of wall \_\_\_\_\_

Basin bottom \_\_\_\_\_

Drain lines \_\_\_\_\_

Electrical equipment, such as flocculators \_\_\_\_\_

What flood level will flood the basins? \_\_\_\_\_

How will you protect the basins, i.e., will you use sandbags or some other means? \_\_\_\_\_

Is the sludge blowdown by gravity? \_\_\_\_\_

Where does blowdown go? \_\_\_\_\_

If blowdown goes to the river or to a lagoon in the floodplain, how will you blowdown during a flood? \_\_\_\_\_

Will a pump(s) be needed? \_\_\_\_\_

Where will you place the pump? \_\_\_\_\_

Where will you get the pump? \_\_\_\_\_

### **Filters**

What are the elevations of the filters?

Top of wall \_\_\_\_\_

Floor of filter \_\_\_\_\_

What flood level will flood the filters? \_\_\_\_\_

How will you protect the filters, i.e., will you use sandbags or some other means? \_\_\_\_\_

Where does backwash go? \_\_\_\_\_

If backwash goes to the river or to a lagoon in the floodplain, how will you backwash during a flood? Water levels may require pumping or higher pump heads. \_\_\_\_\_

Will a pump be needed? \_\_\_\_\_

Where will you place the pump? \_\_\_\_\_

Where will you get the pump? \_\_\_\_\_

How are the filters controlled? \_\_\_\_\_

If controls are automatic, what happens if they quit working? \_\_\_\_\_

Who knows how to backwash the filters? \_\_\_\_\_

### **Clearwells**

What are the elevations of the clearwells?

Base \_\_\_\_\_

Top \_\_\_\_\_

Overflow \_\_\_\_\_

Vent \_\_\_\_\_

Access Hatch \_\_\_\_\_

How will you seal any openings that can be flooded? \_\_\_\_\_

### **Finished Water Pump Station**

What are the elevations of the pumps, motors, and controls? \_\_\_\_\_

How will you protect the motors and controls from flooding? \_\_\_\_\_

Who knows how to control the pumps? \_\_\_\_\_

Who knows how to start the pumps? \_\_\_\_\_

Where are directions for starting and operating the pumps? \_\_\_\_\_

### **Buildings**

Are building structures constructed of fire-safe building material? \_\_\_\_\_

Is reinforced masonry and other hazard-resistant construction used? \_\_\_\_\_

What are the elevations of buildings? \_\_\_\_\_

How will you protect buildings from flooding? \_\_\_\_\_

Will sump pumps be needed to keep buildings dry? \_\_\_\_\_

Where will you get the sump pumps? (see Appendix D) \_\_\_\_\_

Will drains, electrical conduits and pipelines cause problems during a flood? \_\_\_\_\_

What problems? \_\_\_\_\_

How will you protect from flooding? \_\_\_\_\_

### **Administrative Offices and Laboratories**

What are the elevations of any administrative offices? \_\_\_\_\_

Where are records kept? \_\_\_\_\_

How will you protect records from flooding (i.e., move to another building on higher ground)? \_\_\_\_\_

How will you protect equipment, like computers? \_\_\_\_\_

If the lab is damaged, how will you do tests? \_\_\_\_\_

Can the lab equipment be moved to another location for use during an emergency? \_\_\_\_\_

Where? \_\_\_\_\_

Are computers secured to desktops to prevent damage during an earthquake or tornado? \_\_\_\_\_

Are heavier stored objects placed on lower shelves and shelves fastened securely to walls to prevent worker injury and breakage? \_\_\_\_\_

Are all chemicals and laboratory equipment stored in closed cabinets with latches and brackets to keep from falling off shelves? \_\_\_\_\_

Are overhead lighting fixtures anchored to the ceiling? \_\_\_\_\_

## DURING THE EMERGENCY

The damage assessment form at the end of this section can be used to evaluate the condition of the plant during an emergency.

Always check for safety before doing anything!

What needs to be done in an emergency:

- X If unauthorized intrusion is evident, notify law enforcement, determine type of security threat and respond accordingly.
- X Coordinate alternative water supply if necessary.
- X Increase sampling efforts if contamination is threatened.
- X See the treatment responses for various contamination in *General Procedures for Specific Emergencies* under Contamination.
- X Know current flood level and the predicted flood crest.
- X Compare elevations of all basins, buildings and roads to flood levels.
- X Sandbag and do other flood protection before flood levels threaten a basin, building or the plant. When sandbagging buildings or the plant, use a ring dike.
- X Make sure power will be available during any emergency.
- X Get generators if they will be needed. The emergency form lists where to get generators. There is also information in Appendix D.
- X Get extra chemicals if roads and bridges will be inaccessible.
- X Get extra chemicals if the water may be difficult to treat (i.e., chlorine demand will increase with increased organic matter).
- X Keep all basins, filters, and clearwells full. There will be less structural damage and less contamination if they are kept full. Basins and clearwells may move if they are not kept full, equalizing hydrostatic pressure.
- X Get boats or 4-wheel drive vehicles if they might be needed. The emergency form lists where to get these. There is also information in Appendix G.
- X Shut off power to anything that will be flooded.
- X Shut off power to the entire plant, if the plant will flood. Shutting off power protects personnel and equipment.
- X Monitor water quality closely and change treatment as needed if the source is flood waters.
- X Pull all electrical equipment and pumps above flood levels if possible.
- X Move all office equipment and records above flood levels.
- X Move all chemicals above flood levels if possible. In particular, move chlorine containers, as they can break free and will float away.
- X If pipelines under buildings have broken, shut them off to prevent damage to the building foundation.
- X Sandbag or plug floor drains to prevent flood waters from entering.
- X If the plant will flood, use shut off valves to isolate basins, filters, clearwells and the pump station.
- X Backwash and sludge blowdown may be difficult or impossible. Temporary pumps may be needed to continue treating water.

- X Call MDNR for advice and to tell them what is happening. (Phone number is on emergency form and in Appendix A.)
- X If flood waters will cover plant, get another supply. The emergency form should list where you can get tank trucks and potable water or where you can get bottled water. If the sources you prepared for in advance are not available, use Appendix H to find another source.
- X Call MDNR and tell your customers about the need or possible need for using another supply.
- X Keep track of all emergency related labor hours and work repairs performed. Take pictures of all damaged to facilities and building contents.



## **AFTER THE EMERGENCY**

The first thing to do after an emergency is to check the condition of the plant. A form for damage assessment is at the end of this section.

When doing a damage assessment, always check for safety before going in a building, walking around the plant, driving around the plant, or getting out of a truck or car.

The damage assessment should cover:

- X security
- X power supply
- X equipment
- X treatment basins
- X chemical feed and chemical supply
- X filters
- X finished water pumps
- X clearwells
- X offices and lab

Check for gas leaks and do not use matches or lighters until positive indications that no leaks exist. Turn off the gas at the outside main valve if possible and open all windows or doors. Call the gas company to repair any damage or leaks. Contact local electric company regarding downed power lines or debris across lines. Clear debris from facility entrances/exits. Check for damage to electrical/mechanical equipment and systems and clean or replace before returning to service. Check for sewer and water line damage. If you inspect sewage line damage, avoid using the toilets and call a plumbing service. All structures should be inspected for damage. Even if a structure was not submerged, damage may have occurred to the foundation. All yard piping, manholes, and valves should be inspected.

Once damage assessment for the entire system has been done, repair work can be prioritized and repair work can begin.

Any basins that were overtopped will need to be cleaned and disinfected. Basins may need to be pumped out because drains may be full of silt and sand. Pump out gradually (1/3 water per day) to avoid structural damage. Basins may be disinfected in accordance with AWWA Standard C652-02. Major provisions of the standard are as follows:

- X Chlorination of the full volume, to the overflow, such that a residual of 10 ppm is available at the end of 24 hours;
- X or Spraying or painting all water contact surfaces with a solution of 200 ppm available chlorine.
- X Appropriate disposal of all heavily chlorinated waters, to avoid environmental damage.

Filters that were overtopped may require new media if silt from flood waters cannot be removed with backwashing. Filters may be disinfected in accordance with AWWA Standard C653-97. Major provisions of the standard are as follows:

- X Fill the filters with water that has a 25 ppm free chlorine residual for at least 12 hours. A 15 ppm residual should be present at the end of the 12 hours.
- X Backwash filters to remove the heavily chlorinated water.
- X Appropriate disposal of all heavily chlorinated waters, to avoid environmental damage.

If the entire plant was flooded, a supply of potable water will be needed for clean up.

After the emergency is over, damage are assessed and repairs are complete, apply for financial assistance (see Appendix N).